Sanderson

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(71) Applicants
Halo Products Close Corporation

(Incorporated in South Africa)

13th Floor, His Majesty's Building, Joubert Street, Johannesburg, Transvaal Province, Republic of South Africa

(72) Inventor
Ronald Douglas Sanderson

(74) Agent and/or Address for Service
Boult, Wade & Tennant, 27 Furnival Street, London EC4A 1PQ

(54) Preservation of cut flowers

(57) A composition for adding to water for cut flowers to enhance longevity and retard senescence of the flowers includes a sugar constituent which is present in a non-phytotoxic concentration, a pH buffer constituent comprising salicylic acid and/or a salt thereof or sorbic acid and/or a salt thereof or a mixture of any two or more organic acids and/or their salts, which buffer is at least partially soluble in water and a germicide which is present in non-phytotoxic concentrations. A modification of the composition includes a sugar constituent, a pH buffer constituent which comprises either an organic acid or its salt or an antioxidant which is at least partially soluble in water, and a germicide which comprises a sulphur dioxide releasing agent. The anti-oxidant may be hydrazine, sodium bromo-hydride or sodium phytate.

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SPECIFICATION

Composition for retarding senescence of cut flowers in water

This invention relates to a compensation for adding to water for cut flowers to enhance longevity and retard senescence thereof.

According to the invention there is provided a composition for adding to water for cut flowers in a predetermined ratio of the composition to the water, to provide a solution in which cut flower longevity is enhanced and senescence of the cut flowers is retarded, which composition includes

a sugar constituent which is non-phytotoxic in its proposed concentration in the solution;

a pH buffer constituent comprising salicylic acid and/or a salt thereof which is at least partially soluble in water; and

a germicide constituent which is non-phytotoxic in its proposed concentration in the solution.

According to the invention there is further provided a composition for adding to water for cut flowers in a predetermined ratio of the composition to the water, to provide a solution in which cut flower longevity is enhanced and senescence of the cut flowers is retarded, which compensation includes

a sugar constituent which is non-phytotoxic in its proposed concentration in the solution;

a pH buffer constituent comprising sorbic acid and/or a salt thereof which is at least partially soluble in water; and

a germicide constituent which is non-phytotoxic in its proposed concentration in the solution.

According to the invention there is yet further provided a compensation for adding to water for cut flowers in a predetermined ratio of the composition to the water, to provide a solution in which cut flower longevity is enhanced and senescence of the cut flowers is retarded, which composition includes

a sugar constituent which is non-phytotoxic in its proposed concentration in the solution;

a pH buffer constituent comprising a mixture of any two or more organic acids or their salts which are at least partially soluble in water; and

a germicide constituent which is non-phytotoxic in its proposed concentration in the solution.

The organic acids may be selected from the group which includes citric acid, tartaric acid, benzoic acid, iso-ascorbic acid, sorbic acid, and salicylic acid.

Preferably the pH buffer comprises a mixture of salicylyic acid, sorbic acid and benzoic acid in generally equal proportions by mass.

Since, in addition to their pH buffering properties, benzoic acid (in the sodium form) is a germicide, sorbic acid (in its ionic form) is a germicide, and salicylic acid is a germicide, it will be appreciated that each of these acids can serve also as the germicide constituent of the composition.

According to the invention there is even further provided a compensation for adding to water for cut flowers in a predetermined ratio of the composition to the water, to provide a solution in which cut flowers longevity is enhanced and senescence of the cut flowers is retarded, which composition includes

a sugar constituent which is non-phytotoxic in its proposed concentration in the solution;

a pH buffer constituent comprising an organic acid or a salt thereof, or an anti-oxidant that is at least partially soluble in water; and

a germicide constituent comprising a sulphur dioxide releasing agent.

The sulphur dioxide releasing agent may be sodium metabisulphite which releases sulphur dioxide when in the presence of water.

The organic acid may be any of those referred to above, and the anti-oxidant may be selected from the group which includes hydrazine, sodium bromohydride and sodium phytate.

The organic acid or its salt and/or the anti-oxidant as the case may be, should be present in the composition in sufficent concentration(s) to provide the solution with a pH of between 3 and 5,5, preferably 4,5. The resulting acidity of the solution tends to reduce the microbial population and to retard stem blockage and even increase the flow rate of water though the stem segments of certain flowers.

Sugar improves the water balance and osmotic potential of many flowers and the sugar constituent of the composition according to the invention may be selected from the group comprising sucrose, glucose, fructose, lactose, maltose, and/or a mixture of any two or more thereof. The optimal concentration of sugar varies with the variety of the flower. Generally, relatively low concentrations (ie 0,5% to 5% m/m of the solution) is sufficient for most flowers, and in any case, lactose and maltose are active only in low concentrations.

For reasons of economy, it is preferably to use sucrose as the sugar constituent. However, dextrose and glucose may be included in suitable proportions to promote powder flow and thereby to facilitate mixing of the various constituents of the composition.

Certain non-toxic mineral salts can assist the sugar constituent in increasing the osmotic concentration and the pressure potential thereby improving the water balance and longevity of the cut flowers. These include, in non-phytotoxic proportions, potassium chloride, potassium nitrate, potassium sulphate, calcium nitrate, aluminium sulphate, and alum (ie a double sulphate of aluminium and potassium).

The germicide may include a bactericide and/or a fungicide and/or an antibiotic.

Silver nitrate and silver acetate in concentrations in the solution of between 0,02gm/l (20ppm) and 0,035gm/l (35ppm) are two of the most effective bactericides, but are costly. 8-hydroxyquiniline is a broad spectrum bactericide and fungicide and may advantageously be used as the germicide in the composition according to the invention. 8-hydroxy-

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1982.
This print embodies corrections made under Section 117(1) of the Patents Act 1977.

quiniline also serves to reduce physiological stem blocking of the cut flowers.

As an alternative, a halogen releasing agent such as sodium hypochlorite may used, or one or more of the several organic, stabilised, slow-release halogen compounds which are currently available as swimming pool disinfectants. An example of these compounds is sodium dichloroisocyanurate.

The antibiotic, when present, may comprise a yeast inhibitor such as actidione, which is available under the trade name NYSTATIN from Squibb Laboratories and its proportion in the composition may be such as to provide a concentration in the solution of between about 0,5 and 3ppm.

When present, the bactericide may, as mentioned hereinbefore, comprise sodium metabisulphite. Alternatively, or additionally, the bactericide may comprise a quaternary ammonium salt such as that available under the trade name PHYSAN 20 from Corison Pacific Inc, and its proportion may be such as to provide a concentration in the solution of about 20 to 400ppm.

Acceptable ranges of constituents of a composition according to the invention, which composition is intended to be added to tap water in a ratio of 4g/l to 20g/l, are given below:

Constituent	*Proportion in % by mass of composition*
Sugar	83 – 99,6% eg about 98,2%
pH Buffer	0,01 – 15% eg about 0,46%
Germicide	0,3 – 2% eg about 1,375%

The composition of the invention may further include an ethylene inhibitor.

It is common knowledge that senescence of cut flowers is associated with substantial production of ethylene. Thus the composition may include a constituent that inhibits ethylene action or production. Nickel, cobalt (eg as cobalt nitrate), 8-hydroxyquinone, benzoic acid, aminoethoxyvinyl glycine, methoxyvinyl glycine, aminooxyacetic acid, benzothiadiazole, benzylisothiocyanate and ethanol, for example, have been shown to inhibit the production of ethylene in certain cut flowers. Silver (for example as the nitrate or acetate or thiosulphate) does not inhibit the production of ethylene but instead inhibits its deletarious action on and thus reduces senescence of cut flowers.

A preferred formula of the composition according to the invention includes aminooxyacetic acid for its ethylene inhibiting qualities in particular, in such a proportion as to provide a concentration in the solution of between 4mg/l and 60mg/l.

When lignification of the penduncle of the flower is not complete at the time the flower is cut, wilting or bending of the neck of the flower tends to occur. This can also occur under conditions of water stress which can be caused, for example, by the plugging of the vascular bundles of the stems by, *inter alia* microbial action. Thus the composition of the invention may include a suitable cobalt or aluminium salt (eg cobalt nitrate or aluminum sulphate), or a calcium salt, which tends to counteract wilting or neck bending. Suitable proportions thereof are such as to provide a concentration in the solution of between 4mg/l and 20mg/l.

When the calcium salt is present, the calcium can be complexed with EDTA (ethene diamine tetraacetic acid), and the proportion of this complex may be such to provide a concentration in the solution of between 0,2mg/l and 22mg/l.

In excess, nitrate promotes senescence of cut flowers, but in relatively small proportions (ie such as to give a concentration in the solution of between 5mg/l and 100mg/l), they promote photosynthesis and help in the retention of the green colour of the foliage of the flower. Thus when cobalt is included as an ethylene inhibitor, it may be advantageous to include the nitrate salt of the cobalt constituent.

Certain cut flowers require certain trace metals to support function and growth (ie bud opening etc). Accordingly the composition of the invention may include a range of such metals as calcium, magnesium and potassium in non-phytotoxic concentrations thereof.

The compositions according to the invention even further includes a growth or bud-opening stimulator. Cytokinins, auxin, gibberellin and abscisic acid have had limited success, if any, with various flowers. The Applicant has found gibberellin to be a moderately successful stimulent for bud opening in carnations and roses when used in proportions that result in a concentration in the solution of between 5ppm and 60ppm.

Instead, a growth retardant such as butanedioic acid mono-(2,2-dimethylhydrazide) (daninozide, B-Nine), (2-chloroethyl) trimethylammonium chloride) (CCC, chloromequat), chloromequat, maleic hydrazide or α-cyclopropyl -α- (4-methoxyphenyl) -5-pyrimidine-methanol ie ancymidol may be included in the composition to provide a concentration in the solution of between 5ppm and 50ppm. For example, ancymidol reduces stem growth in the vase and assists in keeping the flower stems rigid.

Preferred ranges of essential and optional constituents of a composition according to the invention which is intended to be added to tap water in the ratio of approximately 12gm/l, are set out hereinafter.

Constituent	*Proportion in % by mass of composition*
Sugar	93,8 – 99,2% eg about 97,8%
pH Buffer	0,4 – 1,65% eg about 0,46%
Germicide	0,18 – 1,9% eg about 1,375%
Ethylene inhibitor	0,055 – 0,5% eg about 0,0976%
Anti-wilting/neck bending agent	0,1 – 1,25% eg about 0,11%
Trace minerals	0,02 – 0,04% eg about 0,06%
Growth stimulator or retardant	0,05 – 0,5 eg about 0,0833%

The composition may include a fragrance inducing constituent to provide the solution with a pleasant smell, and may further include an unpalatable constituent such as "BITRIX" (a trade name of Fine Chemical Corporation) to impart a disagreeable taste to the composition and/or to the solution so as to discourage consumption thereof by a person or animal.

The Applicant intends to market the composition in solid form, ie as a powder or in the form of pills. A

lubricant such as sodium lauryl sulphate or magnesium stearate may be included in the composition in those instances where pills are to be produced.

A typical fomulation of a composition according to the invention which is intended to be added to tap water in the ratio of approximately 12gm/l is given below:

Constituent		*Proportion in % by mass of composition*
Sucrose	sugar	
Dextrose	constituent	97,6%
Glucose		
Salacylic Acid	buffer	
Sorbic Acid	constituent	0,275%
Benzoic Acid		
8-hydroxyquinoline (bactericide & fungicide)		1,375%
Sodium metabisulphate (bactericide & fungicide)		0,275%
Aminooxyacetic acid (ethylene inhibitor)		0,09%
Calcium Nitrate (wiling inhibitor)		0.11%
Mineral salts (eg alum) (for plant function and/growth)		0,18%
BITRIX (unpalatable substance)		0,0018%
Perfume (for fragrance)		0,0018%
Magnesium stearate (a lubricant for pill making)		0,18%*
Actidione ('Nystatin') (antibiotic)		0,0825%
Physan 20 (bactericide)		2,0%**

*when present, ie in form of tablet, with corresponding reduction in proportion of sugar constituent

**when present, ie when composition is water based, with corresponding reduction in proportion of sugar constituent

The Applicant expects that all of the above-mentioned constituents of the composition will be used in their dry forms, finely ground for ease of solubility, and marketed as a powder or in pill form in a sachet or other container as the case may be, in which the composition is protected against moisture.

The invention is now described by way of the following non-limiting examples:

EXAMPLE 1

10 flasks were charged with 1000 ml of tap water, and 12g of a composition having the typical formulation given above were added to and mixed into the water in each flask to solubilise the composition as far as possible and to provide a senescence retarding solution.

Fresh cut, flowering roses were placed in the first of the flasks.

Fresh cut rose buds were placed in a second of the flasks.

Flowering roses that had been refrigerated for 7 days at 0°C were placed in the third flask.

Fresh cut, flowering carnations were placed in the fourth flask.

Fresh cut carnation buds were placed in the fifth flask.

Flowering carnations that had been refridgerated for 7 days at 0°C were placed in the sixth flask.

Fresh cut, flowering asters were placed in the seventh flask.

Fresh cut, flowering daisies were placed in the eighth flask.

Fresh cut, flowering chrysanthemums were placed in the ninth flask.

Fresh cut, flowering wild lilies were placed in the tenth flask.

The flasks and flowers they contained were maintained at a constant temperature of about 20°C, under continuous fluorescent lighting, at a relative humidity of between 62% and 68% in circulating air conditions (ie slight wind turbulance). The senescence retarding solution was not replaced during the test/experimental period.

The table below reflects the time taken for the flowers in each flask to evidence the first signs of senescence.

Flask	*Flower*	*Initial Condition of flower*	*Time Period before evidence of senescence (in days)*
1	Roses	Fresh, flowering	10 to 12
2	Roses	Fresh buds	12 to 14
3	Roses	Frozen, flowering	8 to 10
4	Carnations	Fresh, flowering	16 to 28
5	Carnations	Fresh buds	12 to 28
6	Carnations	Frozen, flowering	12 to 16
7	Asters	Fresh, flowering	21 to 42
8	Daisies	Fresh, flowering	21 to 42
9	Chrysanthemums	Fresh, flowering	18 to 28
10	Wild Lilies	Fresh, flowering	12 to 18

In addition to the increased longevity of these flowers, the bloom sizes of the asters and daisies increased significantly and, in certain varieties, doubled.

Advantages of the composition of the invention, at least as exemplified, include its versatility, in that it can advantageously be used with a wide variety of waters (ie having varying salt content) and for a wide range of flowers, and can be used in both winter and summer weather conditions. The solution formed by dissolving the composition of the invention in water can, in some instances, support and even stimulate blossoming of buds to full bloom, and further can produce a better bloom than the flower would have had had it matured in the field. Further, the composition of the invention is relatively economical.

CLAIMS

1. A composition for adding to water for cut flowers, in a predetermined ratio of the composition to the water, to provide a solution in which cut flower longevity is enhanced and senescence of the cut flowers is retarded which composition includes:

a sugar constituent which is non-phytotoxic in its proposed concentration in the solution;

a pH buffer constituent comprising salicyclic acid and/or salt thereof which is at least partially soluble in water or sorbic acid and/or a salt thereof which is at least partially soluble in water or a mixture of any two or more organic acids or their salts which are at least partially soluble in water; and

a germicide constituent which is non-phytotoxic in its proposed concentration in the solution.

2. A composition as claimed in claim 1 wherein the sugar constituent is sucrose, glucose, fructose, lactose, maltose or a mixture of any two or more thereof.

3. A composition as claimed in claim 1 or claim 2 wherein the sugar constituent is present in a concentration of from 0.5% to 5% by weight of the solution.

4. A composition as claimed in any one of the preceding claims wherein the pH buffer comprises a mixture of organic acids which are selected from citric acid, tartaric acid, benzoic acid, iso-ascorbic acid, sorbic acid and salicylic acid.

5. A composition as claimed in claim 4 wherein the pH buffer comprises a mixture of salicylic acid, sorbic acid and benzoic acid and/or their salts in substantially equal weight proportions.

6. A composition as claimed in claim 5 wherein the pH buffer comprises a mixture of sodium benzoate, ionised sorbic acid and salicylic acid and the pH buffer constituent serves also as the germicide constituent of the composition.

7. A modification of the composition as claimed in any one of claims 1 to 3 wherein the germicide constituent comprises a sulphur dioxide releasing agent and the pH buffer constituent comprises an organic acid or a salt thereof or an antioxidant that is at least partially soluble in water.

8. A composition as claimed in claim 7 wherein the sulphur dioxide releasing agent is sodium metabisulphate.

9. A composition as claimed in claim 7 or claim 8 wherein the anti-oxidant is hydrazine, sodium bromohydride or sodium phytate.

10. A composition as claimed in claim 7 or claim 8 wherein the organic acid is citric acid, tartaric acid, benzoic acid, iso-ascorbic acid, sorbic acid or salicylic acid.

11. A composition as claimed in any one of the preceding claims wherein the pH buffer constituent is present in the composiition in sufficient concentration to provide the solution with a pH in the range of from 3 to 5.5.

12. A composition as claimed in claim 11 wherein the pH buffer constituent is present in such a concentration as to provide the solution with a pH of 4.5.

13. A composition as claimed in any one of the preceding claims which additionally includes a non-phytoxic amount of a non-toxic mineral salt or a mixture of such salts in order to assist the sugar constituent in increasing the osmotic concentration and pressure potential.

14. A composition as claimed in claim 13 wherein the mineral salt is potassium chloride, potassium nitrate, potassium sulphate, calcium nitrate, aluminium sulphate or alum.

15. A composition as claimed in any one of the preceding claims wherein the germicide contains a bactericide, a fungicide, an antibiotic or a mixture of two or more of such compounds.

16. A composition as claimed in claim 15 wherein the bactericide is silver nitrate or silver acetate, or a mixture thereof.

17. A composition as claimed in claim 16 wherein the silver salt is present in a concentration of from 0.02 g/l to 0.035 g/l.

18. A composition as claimed in claim 15 wherein the bactericide and fungicide are 8-hydroxyquiniline.

19. A composition as claimed in claim 15 wherein bactericidal and fungicidal properties are provided by

a halogen releasing agent.

20. A composition as claimed in claim 19 wherein the halogen releasing agent is an organic stabilised slow-release halogen compound.

21. A composition as claimed in claim 19 wherein the halogen releasing agent is an organic stabilised slow-release halogen compound.

22. A composition as claimed in claim 21 wherein the halogen compound is dichloroisocyanate.

23. A composition as claimed in any one of claims 15 to 22 wherein the antibiotic comprises a yeast inhibitor.

24. A composition as claimed in claim 23 wherein the yeast inhibitor is actidione.

25. A composition as claimed in claim 23 or claim 24 wherein the yeast inhibitor is present in such a concentration as to provide a concentration in solution of from 0.5 to 3 ppm.

26. A composition as claimed in any one of the preceding claims wherein the germicide comprises a quaternary ammonium salt.

27. A composition as claimed in claim 26 wherein the quarternary ammonium salt is preent in such a concentration as to provide a concentration in solution of from 20 to 400 ppm.

28. A composition as claimed in any one of the preceding claims which comprises from 83 to 99.6% by weight of sugar and from 0.1 to 15% by weight of the pH buffer and from 0.3 to 2% by weight of the germicide.

29. A composition as claimed in any one of the preceding claims which also comprises an ethylene inhibitor.

30. A composition as claimed in claim 29 wherein the ethylene inhibitor is nickel, cobalt, 8-hydroxy-quinone, benzoic acid, aminoethoxyvinyl glycine, methoxy vinyl glycine, amino oxyacetic acid, benzothiadiazole, benzylisothiocyantate, ethanol or silver.

31. A composition as claimed in any one of the preceding claims wherein a salt of cobalt, aluminium or calcium is present in an amount so as to provide a concentration in the solution of from 4 mg/l to 20 mg/l.

32. A composition as claimed in claim 31 wherein the salt is of calcium and the calcium is complexed with EDTA to provide a concentration in solution of the complex of from 0.2 mg/l to 22 mg/l.

33. A composition as claimed in any one of the preceding claims which additionally includes one or more of a trace element to support function and growth of the cut flowers, a growth or bud-opening stimulator, a growth retardant, a fragrant constituent, an impalatable constituent or a lubricant.

34. A solution formed by dissolving a composition as claimed in any one of the preceding claims in tap water.

35. A solution as claimed in claim 34 wherein the composition is added to tap water in an amount of from 4 g/l to 20 g/l.

36. A method for enhancing longevity and delaying senescence of cut flowers which comprises adding a composition as claimed in any one of claims 1 to 33 to tap water and standing the cut flowers therein.

37. A composition substantially as hereinbefore described with reference to the example.

38. A solution substantially as hereinbefore described with reference to the example.

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